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UNITED STATES DEPARTMENT OF AGRICULTURE  
Agricultural Research Administration  
Bureau of Agricultural and Industrial Chemistry  
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October 1, 1952

BUREAU MEMORANDUM NO. 427 NOV 28 1952

Recent Industrial Applications of Products,  
Processes, and Equipment Resulting from BAIC  
Research on the Utilization of Farm Products

TO ALL PERSONNEL, BUREAU OF AGRICULTURAL AND INDUSTRIAL CHEMISTRY:

A considerable amount of the Bureau's research during the past year has resulted in developments that have been adopted by industry or are being tested for possible commercial production. All of us have shared in these accomplishments, and the story of them is both interesting and informative.

Therefore, as in 1949 and again last year, I am submitting brief descriptions of some of these developments. The attached summary includes information on 16 of the more important products, processes, and items of equipment that are now in commercial production or use, or being actively considered by industry.

G. E. Hilbert

G. E. Hilbert  
Chief of Bureau

Attachment

THE UNIVERSITY OF CHICAGO  
DEPARTMENT OF CHEMISTRY  
CHICAGO, ILL. 60637

February 1, 1953

JOHN W. BOYD

1000 North Dearborn Avenue  
Chicago 10, Illinois

Dear Mr. Boyd:

I have just received your letter of January 28, 1953, regarding the matter of the purchase of a certain quantity of material. I am sorry that I cannot give you a more definite answer at this time, but I am sure that you will understand my position.

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Sincerely,  
J. W. Boyd

Enclosure



UNITED STATES DEPARTMENT OF AGRICULTURE  
AGRICULTURAL RESEARCH ADMINISTRATION  
BUREAU OF AGRICULTURAL AND INDUSTRIAL CHEMISTRY

October 1, 1952

RECENT INDUSTRIAL APPLICATIONS OF PRODUCTS, PROCESSES,  
AND EQUIPMENT RESULTING FROM BASIC RESEARCH ON THE  
UTILIZATION OF FARM PRODUCTS

The following statements briefly describe products, processes, and items of equipment that have resulted from investigations by the Bureau of Agricultural and Industrial Chemistry to expand the utilization of agricultural commodities. They are limited to developments that have been adopted during the past year by industry or that are now undergoing test for possible commercial production or use.

\* \* \* \* \*



### New Body-conforming Bandage Now Produced Commercially

A new type of cotton bandage developed in the Bureau during World War II is now being made commercially for the Armed Forces, and may soon be available for civilian use. Outstanding feature of this new bandage is its ready adaptability to irregular contours of the body. In recent tests in Army hospitals and field stations in Korea, the conforming bandage performed better than other types for securing newly developed special dressings to multiple wounds and large burned areas. As a result of these successful evaluations, the Office of the Surgeon General requested manufacturers to undertake commercial production. Two companies have developed equipment for commercial production, and an initial order for more than 5 million bandages has been placed by the Armed Forces Medical Procurement Agency. The new bandage costs less than half as much as other suitable bandages. It is anticipated that the savings to the Armed Forces will amount to several million dollars annually.

A development of SRRL.\*

### Grape Juice Now Prepared in Superconcentrated Form

A new superconcentrated, full-flavor grape juice, which is diluted to drinking strength by adding six volumes of water to one of juice, has been developed, and should be of special interest as a space saver for use on submarines, where space is at a premium. Such a product should also have possibilities for domestic consumption, since a four-ounce can of the superconcentrate yields even more juice than the conventional six-ounce can of frozen concentrate.

The new product takes up less space in the housewife's refrigerator, and commercial packs in large containers have been put up by at least one company for use in various fruit preparations. The new concentrate has been kept under ordinary refrigeration (35°F.) for a year, with no deterioration or spoilage. This elimination of the need for frozen storage permits economies in storage and transportation of the product. The superconcentrate is an outgrowth of ERRL's essence recovery process. Essence is removed from conventional grape juice and concentrated, and the stripped juice is depectinized and concentrated. The essence, concentrated stripped juice, and sugar solution (if desired) are then combined in the proper amounts to make the concentrate, which is canned.

A development of ERRL.

\* See last page for full names of laboratories, and key to abbreviations.



### Dextran - Important as a Blood Plasma Extender

The national need for a blood plasma extender available in sufficient quantities for emergency use in treatment of shock, burn, and hemorrhage casualties which could result from a large-scale catastrophe is clearly evident. Although there is no complete substitute for whole blood in this medical field, adequate supplies of blood and plasma would never be available in such a disaster. To fill this important need, the Bureau has, in a relatively short time, developed a fermentation process for preparing the product dextran which meets medical requirements, as well as those of stability, availability, low cost, and ease of shortage. Serving as a basis for this development was the earlier work of the Bureau on production of dextran in connection with structural studies of carbohydrate materials.

The Bureau's process was built around the organism Leuconostoc mesenteroides NRRL B-512, which had, at an even earlier date, been isolated by Bureau workers from a bottle of slimy root beer. Much fundamental research has necessarily been a part of the dextran development program in the establishment of proper cultural conditions and molecular size distribution. The Bureau's organism is now used not only by the three companies known to be producing dextran for the Armed Forces, but by all other concerns working on this development.

A development of NRRL.

### Dried Whole Eggs Suitable for Domestic Use Developed

Dried whole eggs have been improved greatly during the past 10 years. It is now practical to produce packaged dried whole egg that is fifty times as stable as that produced in 1942 and 1943. The most recent improvement, one that has solved the browning problem in dried whole egg, is based on the demonstration by this Bureau that glucose (normally present to the extent of about 1 percent of the egg solids) is the cause of the browning and principal off-flavor development in the fat components of the egg.

It was shown that more or less standard techniques for resting cell fermentations with bakers yeast could be used to destroy the glucose in a short time without production of off-flavors during processing. These findings have led workers elsewhere to adapt glucose oxidase to the job of destroying glucose (by conversion to gluconic acid) in liquid whole egg that is to be dried. Glucose-free dried whole egg and also glucose-free dried yolk is now being used on an increasing scale in prepared dry cooking mixes, and also in some commercial bakeries.

A development of WRRL.



### Glass Color Standards Help Honey Marketing

New glass color standards are now a valuable aid in marketing extracted honey. Developed cooperatively through research by the Bureau and the Production and Marketing Administration, they replace the cumbersome Pfund wedge comparator for grading honey, which was impractical for field use. The new color standards are permanent, inexpensive and simple to use; they employ amber glasses prepared to specifications based on spectrophotometric measurements. The glass standards, six in all, are now the official USDA color standards for extracted honey. They are available commercially as part of a color comparator kit, and help in the orderly and uniform marketing of honey, to the benefit of both producers and consumers.

A development of ERRL.

### New Information on the Dry Grinding of Agricultural Residues

Using new processes and information developed by the Bureau, the dry grinding of such agricultural residues as corncobs, fruit pits, nut shells, and rice hulls has become a soundly established business. At the present time, 24 plants, operating in the majority of the North Central States, are producing cob products useful in both industry and agriculture. In addition, 10 widely distributed grinding plants are now processing nut shells and fruit pits for numerous industrial uses.

Information being furnished (Bureau publication AIC-336) to this rapidly growing industry includes data on the availability, chemical and physical characteristics, accumulation, and end uses of such agricultural residues, as well as on merchandising methods for the industry. Such problems of processing as grinding and classifying, and fire and explosion hazards, are explained in the light of data accumulated from actual tests made in the Bureau. Included also are the most recent developments in the industrial utilization of various components of corncobs.

A development of NRRL

### Epoxidized Oils Serve Dual Purpose

Epoxidized oils, developed by the Bureau, are now made in substantial quantities for use as plasticizers in vinyl plastic formulations. Certain epoxidized oils not only have valuable plasticizing properties, but, because they combine with and neutralize hydrogen chloride, they prevent the discoloration of plastic products caused by the hydrogen chloride released from polyvinyl chloride on exposure to heat and light. Unlike lead and other materials that also prevent this discoloration, these oils have no adverse effect on the transparency of the plastic products. The Bureau method for preparing the epoxidized oils is cheap and practical, and may be used with a wide variety of oils, both animal and vegetable.

A development of ERRL.



### Equipment for Flash Heating and Concentration of Juices

New equipment has been developed for the flash pasteurization and rapid single-pass concentration of heat sensitive fluid food products. The primary element in this equipment is a new type of steam injection heater which accomplishes pasteurization on most products without flavor damage. The steam injection heater is also used as the preheater in a single-pass evaporator, designed specifically to accomplish concentration without heat damage, and without fouling of heat transfer surfaces. The evaporative efficiency of the new model exceeds that of the conventional evaporators by three to ten times.

Commercial interest in this work is strong, and a number of commercial applications have been made on the basis of our developments. As a direct result of our work, two plants are using steam injection heating to improve cloud stability in frozen orange juice concentrate, and evaporators employing steam injection heating are being successfully operated on a commercial scale on tomato juice, apple juice, and pear puree. One equipment manufacturer is currently engaged in an advertising campaign for the sale of equipment based on this development.

A development of WRRL.

### Research Aids Establishment of Rice Bran Oil Industry

The production of rice bran oil increased from a negligible amount in 1949 to 9.5 million pounds in 1951, and an estimated 14 million in 1952. About 3/4 of that produced was consumed in edible products, particularly salad oils and dressings, and the remainder was consumed in the manufacture of industrial products, principally sulfonated oil. The amount marketed may be expected to increase since only a fraction of the 50 million pounds available was recovered, and new processing plants are getting into production. Bureau research contributed significantly to the development and establishment of this new vegetable oil industry.

The investigations provided technical information on the prevention of deterioration of the oil in the bran between milling and extraction, on methods of refining the extracted oil to improve the yield and quality of the product, on the properties of the oil for specific uses, and on the yields of oil to be expected from brans of different variety and origin. The research team responsible for this development was given the Distinguished Service Award in 1952.

A development of SRRL.



### Global Edible Spread

A margarine-like material which is spreadable at temperatures below 34° F., and yet maintains its form at 110° F., has been made by the Bureau in response to a request from the Quartermaster Corps for an all-climate spread for bread. This product is being evaluated by the Food and Container Institute, and is superior in plasticity to high melting margarines presently available which must be shaved off to be used in cold climates, and which melt in the tropics.

Since the global spread contains no water, separation of the emulsion as in butter and margarine does not occur. It is composed of nutritionally proven and naturally occurring lipids, e. g., vegetable oils and lard monoglycerides; it is formulated with salt, butter colors, and flavors, and is fortified with vitamins A and D. Production is accomplished in the usual margarine texturizing equipment and the cost is expected to approximate that of margarine.

A development of NRRL.

### Improved Techniques for Processing Cotton

Textile mills are adopting the improved techniques developed in Bureau-sponsored research on the manufacture of cotton textiles. The research findings upset 150-year-old concepts in the cotton industry, and showed that the use of newly recommended speeds and settings for carding machines would reduce neps about 50 percent. The textile industry has been plagued for more than a century by neps - those tiny tangles of cotton fibers that lower the quality of fabrics where appearance is of major importance.

In addition to the development of new techniques for reducing nep formation - the principal object of the research - there were two important byproducts of the study: an increase in cotton card production, and a reduction in waste. Experiments indicated that card production can nearly be tripled in some cases, and that the amount of spinnable fiber removed as flat strips at the card can be reduced about one percent. If the entire cotton industry adopted these recommended changes in processing techniques, the increase in production through less spinnable fiber removed as waste would be equivalent to 100,000 bales annually. A number of mills have already benefited through the application of the research findings. One medium-sized mill reported an estimated saving of about \$170,000 for the first year - a sum nearly three times the cost of the research.

A development of contract research sponsored by SRRL



### Air Lift Drier for Potato Granules

The avoidance of product damage during drying has been regarded as one of the main problems in the commercial production of high quality mashed potato powder (potato granules) to supply the requirements of our armed forces. Research on this problem, initiated at the outbreak of the Korean war, has resulted in the development of a new type of air lift drier, designed to accomplish the drying without damaging the granules by heat or mechanical abrasion. In this type of drier, the product is dried while being carried upward by a hot air stream in a vertical column. The column is expanded at the top to reduce air velocity. The air velocity is adjusted so that the dry granules are carried out of the drier, while the denser, moist particles are retained for further drying.

One feature of the drier is a collector which provides for a single change of direction for the fragile granules while they are carried at a relatively low velocity. The product is thus subjected to a minimum of impact and abrasion damage. Several processing plants have incorporated this Bureau-designed air-lift drier in production lines to serve the functions of conveying and cooling as well as drying. One firm has a pilot-size drier in operation for developmental studies.

A development of WRRL.

### Microscopic Test for Milling Quality of Wheat

Wheat breeders in the Pacific Northwest are especially interested in finding a method by which milling quality of a new variety can be predicted when only a few kernels are available for testing. The poor milling of agronomically popular Rex variety called special attention to the problem in that area. Microscopic studies made in the Bureau on seven Pacific Northwest wheat varieties showed that thickness of the endosperm cell walls was directly related to milling quality; the greater the cell wall thickness, the poorer the variety's milling quality. Wheat breeders in the Pacific Northwest are already using this method to screen breeding stock.

Since measurement of cell wall thickness is time-consuming, the possibility of developing a more rapid test was investigated. Cell contents were removed from thin sections of kernels, and the sections then were treated with chemicals to dissolve or hydrolyze the water-insoluble hemicelluloses of the cell walls. The endosperm cell walls were most affected in good-milling wheats, and least in poor-milling varieties, but wheats of intermediate milling quality were not distinguishable. Refinements of the method are in progress, in an attempt to make the comparatively rapid tests thus afforded more definitive.

A development of NRRL, in cooperation with WRRL and the Western Wheat Quality Laboratory (EPISAE).



### Recovery of Fruit Aroma from Preserves Tested on Commercial Scale

A simple process has been devised to recover the volatile fruit flavors which would normally be lost during the manufacture of jams and preserves. The recovered flavor may be restored to the preserve to enhance its true fruit flavor, or may be used to flavor other products. Waste of natural flavors is thus avoided. Through the cooperation of a preserve manufacturer, flavors were recovered during commercial operations.

Preserves are usually made by concentrating a mixture of fruit, sugar, and pectin under vacuum. For flavor recovery, a surface condenser is installed on the vacuum pan, and the condensate is sent to conventional essence-recovery apparatus. Here the fragrant substances are stripped from the condensate, and concentrated to an aqueous essence.

If the essence is restored to the preserves, their flavor and aroma will be stronger and more characteristic of the fruit. But if the preserve flavor is sufficiently characteristic and strong without such restoration - such as cherry preserves - the essence can be used to flavor such things as candy, ice cream, and carbonated beverages.

A development of ERRL.

### New-type Fats from Cottonseed and Peanut Oils

Non-greasy and highly flexible fats have been prepared by a simple and inexpensive process from readily available fats and oils. These products have attracted wide interest in the food industry because a need has existed for a long time for an edible flexible material to replace paraffin and other non-fat coatings. The new-type fats, known chemically as acetostearins, can be produced with melting points ranging from 80° to 140° F. (that is, from 20° below to more than 40° above body temperature).

At least one company is preparing the new products on a pilot-plant scale and distributing samples to potential users for evaluation purposes. If tests underway by several laboratories confirm the belief that acetostearins are edible and digestible, the products may find use as coatings for cheese, weiners, ice cream bars, and other food products. Confectioners found the products excellent as a slab dressing in candy making.

A development of SRRL.



## Improved Sauces and Gravies Developed for Use in Precooked Frozen Foods

Producers of precooked frozen foods have searched for a number of years for some means of preventing the liquid separation and curdled appearance that occurs when products containing sauces or gravies are thawed for use. The unattractive appearance of these products is evident when they are thawed immediately after freezing, and it becomes more pronounced with storage. We have found that waxy rice flour is a practical solution to this problem. Waxy rice flour is now being used by several manufacturers as the thickening agent for precooked frozen foods containing sauces and gravies. It is being tested by a number of others. Growers of waxy rice have increased the acreage allotted to this crop, in anticipation of the increased demand for it.

Since instabilities such as gelation and liquid separation are defects frequently encountered in the food industry, the results obtained in this research have implications that go beyond frozen sauces and gravies. Tests conducted at this laboratory and at the Quartermaster Food and Container Institute indicate it may solve a problem of gelation in certain thickened canned foods. It promises to make possible the freezing of certain egg-containing desserts, cake fillings, and puddings similar to those ordinarily thickened with corn-starch.

A development of WRRL.

### NAMES OF LABORATORIES AND KEY TO ABBREVIATIONS

The research developments described herein are products of the following laboratories. A number of other laboratories are maintained by the Bureau in addition to those listed.

ERRL - Eastern Regional Research Laboratory, Philadelphia  
18 (Wyndmoor), Pa. Dr. P. A. Wells, Director

NRRL - Northern Regional Research Laboratory, Peoria 5, Ill.  
Dr. R. T. Milner, Director.

SRRL - Southern Regional Research Laboratory, New Orleans 19,  
La. Dr. C. H. Fisher, Director.

WRRL - Western Regional Research Laboratory, Albany 6, Calif.  
Dr. M. J. Copley, Director.

BPISAE - Bureau of Plant Industry, Soils, and Agricultural  
Engineering, Beltsville, Md.



